

UNITED STATES PATENT APPLICATION

OF

YOUNG TAE YANG

KYONG RAK LEE

FOR

FLEXIBLE PRINTED CIRCUIT FILM

LONG ALDRIDGE & NORMAN LLP
701 Pennsylvania Avenue, N.W., Suite 600
Washington, D.C. 20004
(202) 624-1200

This application claims the benefit of Korean Patent Application No. P00-38468 filed on July 6, 2000 which is hereby incorporated by reference as if fully set forth herein.

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a flexible printed circuit film, and more particularly to a flexible printed circuit film that is capable of preventing a bonded pad from being separated or opened due to a tension applied to a bonded part when the flexible printed circuit film is engaged to a printed circuit board.

Discussion of the Related Art

Generally, a liquid crystal display (LCD) module controls light transmissivity in accordance with an electric field to thereby display a picture corresponding to video signals. To this end, the liquid crystal display module includes a liquid crystal display panel having a plurality of pixels arranged in a matrix and a driving circuit for driving the liquid crystal display panel.

Each pixel arranged on the liquid crystal display panel includes a liquid crystal cell positioned at an intersection between a gate line and a data line, and a thin film transistor (TFT) for selectively connecting the liquid crystal cell to the data line in response to a signal on the gate line. The driving circuit for driving the liquid crystal display panel consists of a data driving integrated circuit (IC) for driving the data lines on the

liquid crystal display panel, a gate driving IC for driving the gate lines on the liquid crystal display panel, and a control circuit for controlling the gate driving IC and the data driving IC. These driving IC's usually take the shape of a chip and are mounted in a tape carrier package (TCP) in the case of a tape automated bonding (TAB) system, or on the surface of the liquid crystal display panel in the case of a chips on glass (COG) system.

In the case of the TAB system, the driving IC's are electrically connected to a pad provided at the liquid crystal display panel by the TCP. For instance, in the LCD module of a TAB system, as shown in Fig. 1, the rear side of a liquid crystal display panel 1 is provided with a timing control board 6, a data circuit board 4, flexible printed circuit (FPC) film 12 and a gate circuit board 2. Data driving IC chips 10 are loaded in a TCP 8 to be connected, via the TCP 8, to the liquid crystal display panel 1 and the data circuit board 4. Gate driving IC chips (not shown) also are loaded in the TCP 8 to be connected, via the TCP 8, to the liquid crystal display panel 1 and the gate circuit board 2. The data circuit board 4 is connected, via the FPC film 12, to the timing control board 6 to relay a data transmission between the timing control board 6 and the data driving IC chips 10. The gate circuit board 2 also is connected, via a FPC film (not shown), to the timing control board 6 to relay a signal transmission between the timing control board 6 and the gate driving IC chips.

The FPC film 12 connected between the data circuit board 4 and the timing control board 6 usually has an "L"

shape. The timing control board 6 applies a data control signal, which includes a data signal and a synchronizing signal, etc., via the FPC film 12, to the data circuit board 4. Further, the timing control board 6 applies a gate control signal, which includes a synchronizing signal, etc., via the FPC film (not shown), to the gate circuit board 2. The TCP 8 loaded with the data driving IC chips 10 is electrically connected to one pad area of the liquid crystal display panel 1 and, at the same time, one edge of the data circuit board 4. In a similar manner, the TCP loaded with the gate driving IC chips also is electrically connected between the liquid crystal display panel 1 and the gate circuit board 2.

The FPC film 12 includes a first pad 16 for connecting to a pad of the data circuit board 4, and a second pad 18 for connecting to the timing control board 6. The first pad 16 is adhered to the pad of the data circuit board 4 by an anisotropic conductive film. The second pad 18 of the FPC film contacts a connector 14, which is provided at one end of the timing control board 6. To engage the second pad 18 of the FPC film 12 with the connector 14, force is applied from the exterior to the connector 14 in the "A" direction toward the second pad 18, as shown in Fig. 2. At this time, force is transferred via a body of the FPC film 12, into the first pad 16. Thus, a contact portion between the first pad 16 and the pad of the data circuit board 4 is separated or opened by the force transferred to the first pad 16. This causes a serious problem of an electrical breakage between the timing control board and the data circuit board.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a flexible printed circuit film that is capable of preventing a bonded pad from being separated or opened due to tension applied to a bonded part when the flexible printed circuit film is attached to a printed circuit board.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

In order to achieve these and other objects of the invention, a flexible printed circuit film according to the present invention includes a body; a first pad provided at one end of the body to be adhesively connected to a pad of a first printed circuit board; a second pad provided at other end of the body to be engaged to a connector of a second printed circuit board; and at least one recess defined at the body.

In the flexible printed circuit, the recess is defined at each side surface of the body adjacent to the second pad. The body has at least one bent portion, and said recess is defined at the bent portion. Alternatively, said at least

one recess is defined at the bent portion and said at least one recess is at the body adjacent to the second pad.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

Fig. 1 is a schematic perspective view showing a structure of a conventional tape carrier package-type liquid crystal display module;

Fig. 2 is a plan view of the flexible printed circuit film shown in Fig. 1;

Fig. 3 is a plan view of a flexible printed circuit film according to a first embodiment of the present invention; and

Fig. 4 is a plan view of a flexible printed circuit film according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

Referring to Fig. 3, there is shown a flexible printed circuit (FPC) film according to a first embodiment of the present invention. The FPC film 20 includes a first pad 24 connected to a pad of a data circuit board (not shown), a second pad 26 for connecting to a connector 28 of a timing control board (not shown), and first and second recesses 20a and 20b defined at the bent or corner portion of the FPC film 20. The FPC film 20 is positioned between the timing control board 6 and the data circuit board 4, as shown in Fig. 1, to electrically connect them. The FPC film 20 has substantially an "L" shape, having a single bent or corner portion. The first pad 24 of the FPC film 20 is adhesively connected to the pad of the data circuit board by an anisotropic conductive film. The second pad 26 engages the connector 28 of the timing control board 6. To prevent the force applied to engage the connector 28 to the second pad 26 from being transferred to the first pad 24 via the FPC film 20, first and second recesses 20a and 20b are defined at the bent portion of the FPC film 20. The first and second recesses 20a and 20b are formed respectively at an inner side of the FPC film 20 at a vertex of FPC film 20, i.e., where the FPC film 20 is bent at substantially a right angle, and at an outer side of the FPC film. Such recesses 20a and 20b absorb a force transferred, via a body of the FPC 20, to the first pad 24 upon engagement of the connector 28 to the second pad 26. Accordingly, it becomes possible to prevent a contact

portion between the first pad 24 of the FPC film 20 and the data circuit board from being separated or opened as a result of the force applied to the connector 28. Furthermore, the recesses 20a and 20b prevent movement of the FPC film 20 in the direction in which the connector 28 is engaged or assembled, thereby allowing simplified assembly of the second pad 26 of the FPC film 20 and the connector 28.

Referring to Fig. 4, there is shown a flexible printed circuit (FPC) film according to a second embodiment of the present invention. The FPC film 30 includes a first pad 32 connected to a pad of a data circuit board (not shown), a second pad 34 for connecting to a connector 36 of a timing control board (not shown), and first and second recesses 30a and 30b defined at a portion adjacent to the second pad 34 of the FPC film 30. The first pad 32 is adhesively connected to the pad of the data circuit board by an anisotropic conductive film. The second pad 34 engages the connector 36 of the timing control board.

The first and second recesses 30a and 30b are provided in such a manner to be adjacent to the second pad 34. In other words, the first and second recesses 30a and 30b are defined at each side surface between a bent or corner portion of the FPC film 30, which has substantially an "L" shape, and the second pad 36. Such recesses 30a and 30b absorb a force transferred, via a body of the FPC 30, to the first pad 32 to engage the connector 36 to the second pad 34. Accordingly, it becomes possible to prevent a contact portion between the first pad 32 of the FPC film 30 and the data circuit board from being separated or opened

because of the force applied to the connector 36. Furthermore, the recesses 30a and 30b prevent movement of the FPC film 30 in the direction in which the connector 36 is engaged or assembled, thereby allowing simplified assembly of the second pad 34 of the FPC film 30 and the connector 36.

As described above, according to the present invention, each side surface of the FPC film is provided with the recesses, so that it becomes possible to prevent a contact portion between other pad of the FPC film and the pad of the data circuit board from being separated or opened because of a force applied upon engagement of one pad of the FPC film to the connector of the timing control board. Furthermore, the recesses defined at each side surface of the FPC film prevent movement of the FPC film a connector engagement direction, thereby allowing an easier engagement of the connector and the FPC film.

It will be apparent to those skilled in the art that various modifications and variation can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.